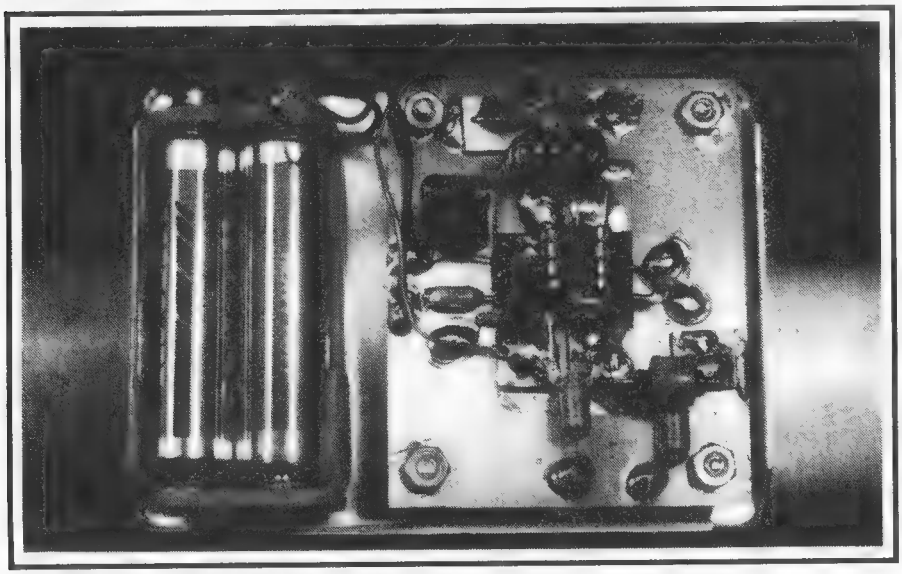
Receivers

Simple LF Receiving Converter

Drew Diamond VK3XU describes another useful receiving unit for the shack.*



LF converter circuit board and batteries mounted in a small box.

In the happy event that amateurs gain an allocation in the 160 — 190 kHz band, it would be good to be able to listen to signals on this band. Indeed, some experimenters are already operating in this region. Here are details of a simple converter which provides adequate signal handling and coverage from (nominally) 10 kHz to about 500 kHz.

The Civil Aviation Authority operates numerous non-directional beacons (NDBs) as navigation aids for aircraft. On LF (or "long wave") they range in frequency from about 200 kHz to 420 kHz, and consist of a carrier amplitude modulated by a Morse identifier of usually two or three letters. For instance, Essendon near Melbourne is EN, Wonthaggi is WON.

These make excellent practice material for persons in the early stages of learning the code. Character speed is about 8 wpm, so the student soon learns to recognise the collection of letters being sent repeatedly under actual "radio" conditions. Even the most reluctant student will find it a painless and effective introductory method if run in the background whilst doing other "more important" things.

Circuit

A simple low pass filter significantly attenuates antenna signals above about 500 kHz so that broadcast stations do not overload the mixer. An NE602AN balanced mixer IC has its local crystal oscillator running at (say) 3 MHz, making 3.000 MHz equal to zero reference (0 kHz). For example, a signal on 190 kHz will therefore be converted to 3.190 MHz, and a signal on 300 kHz will appear on 3.300 MHz, which may be tuned by an ordinary SW or HF receiver (without in-built antenna) which covers that range. Similarly, a 3.5 MHz conversion crystal would have 0 kHz at 3.500, a 4 MHz crystal at 4.000 MHz and so on.

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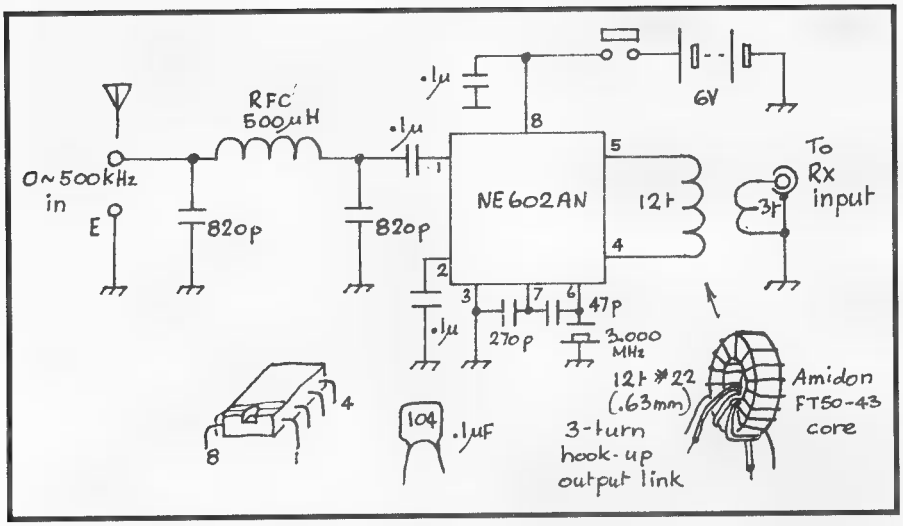

Figure 1 — Circuit diagram of the LF converter.

Input and output networks are untuned, and there are no adjustments to make. Current demand from a 6 V supply is only 2.5 mA, hence battery operation from a set of 4 pen-light cells is a good plan. Maximum specified supply for the '602 is 8 V.

Construction

The NE602AN chip is inserted into a wire-wrap socket, which in turn is soldered to a pad-board (see Ref 5) substrate attached to a piece of circuit board measuring 65 x 50 mm. 3 and 4 MHz crystals are available "off the shelf" as cheap computer units (although the 3 MHz is dearer). Either frequency, or perhaps a slightly higher round-numbered one which suits your receiver's range, such as 5 or 6 MHz, is suggested. However, 3 MHz is recommended, because there are not (in VK3 at present) a lot of powerful signals in the 3 to 3.5 MHz range which may "break through" into this IF.

Circuit board and battery may be accommodated in a small metal or plastic box, with suitable connectors as shown.

Operation

Use a coax lead to connect the output of the converter to the input of your receiver. Background noise should increase just a little when the converter is switched on. Tune the receiver to the crystal frequency (zero reference or 0 kHz), where a moderately strong carrier should be noted. Connect a wire antenna to the converter input. At these frequencies a short antenna of a few tens of metres merely forms a non-resonant voltage probe. Even a wire of only a few metres will bring in many signals.

As mentioned above, mentally subtract your crystal frequency from the positive dial reading to obtain the actual receive frequency. Down near 10 kHz (if your home is like mine) you will hear a mish-mash of buzz from all those horrible switch-mode power supplies and TV sets in the area. But above about 200 kHz, the smog should clear a little and allow the beacons and other signals to be tuned.

Beacon signals have been received here from many parts of Victoria, southern NSW and King Island (KII) on a 10 m length wire antenna. A separate earth connection (that is, independent from the mains earth supplied by the receiver connection) may or may not improve the signal to noise level, so give it a try.

References and Further Reading

1. *Tune in on the New Frontiers of VLF — Curry, 73 Amateur Radio, June '90.*
2. *A Bandwidth Limiting LF Up Converter for Around 200 kHz — Butler, Amateur Radio Dec '93.*
3. *The Bandwidth Limiting Converter Simplified — Butler, Amateur Radio Jan '94.*
4. *Modifications to the Bandwidth Limiting Converter to include VLF — Butler, Amateur Radio Mar '94.*
5. *"Paddyboard" Circuit Construction — Diamond, Amateur Radio Feb '95.*

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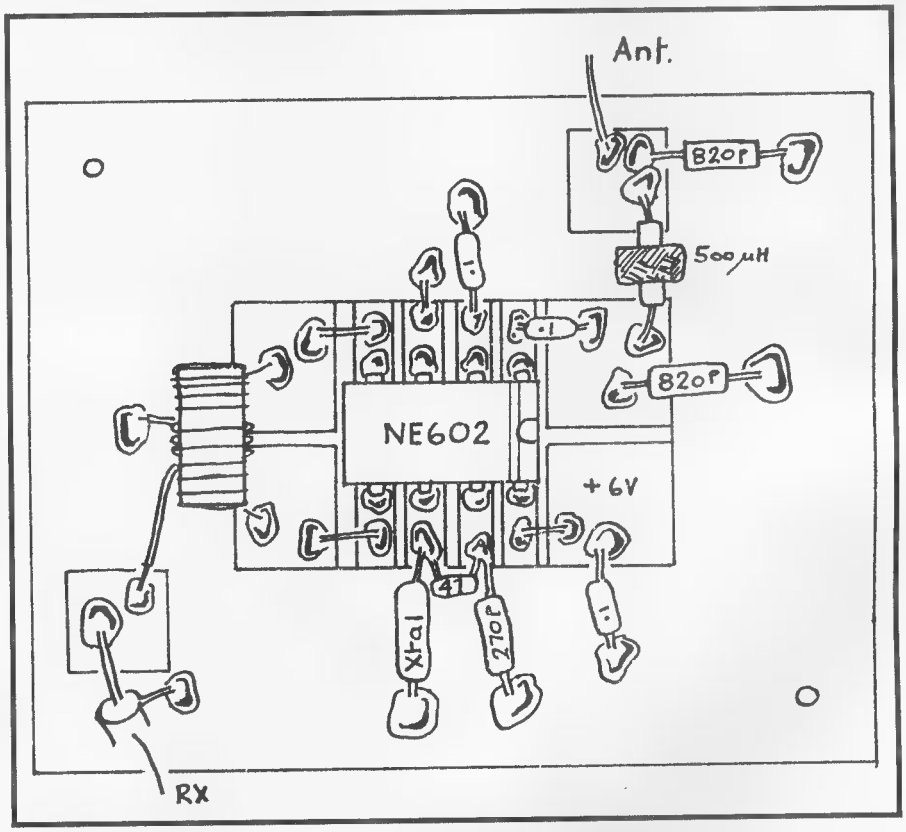

Figure 2 — Circuit board layout for the LF converter.